REMARKS

In the office action mailed July 26, 2005, claims 1 - 20 were rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,847,959 (to Veneklasen et al.) in view of U.S. Patent No. 5,051,598 (to Ashton et al.).

The Veneklasen et al. reference discloses a system and method for proximity effect correction in a raster scan writing strategy for an electron beam pattern generating system (Veneklasen et la., col. 4, line 66 - col.5, line 1). Although the Veneklasen et al. reference involves proximity effect correction by modifying the dose at each site (x,y), the *methodology* employed by the Veneklasen et al. reference for determining the modified doses is very different from that of the present invention and does not teach or suggest the methodology used in the present invention for determining the modified doses.

The Veneklasen et al. reference involves determining a total exposure P(x,y) of a site (x,y) including all contributions from all nearby sites, and discloses that this determination is made using a convolution calculation (Veneklasen et al., col.5, lines 33 -43) that employs a point spread function (Veneklasen et al., col.5, lines 39 - 43) to develop a modified map (Veneklasen et al., col.5, lines 55 - 57) for long range effects. Applicants also disclose that the total exposure including the contributions from all nearby sites may be determined by a convolution function (Application, p. 6, line 20 – page 7, line 4) that employs a point spread function in an embodiment (Application, p.6, line 22).

The present invention, however, then employs a very different methodology for determining the optimized doses to correct for proximity effects. Applicants' methodology is

fundamentally different than the methodology of Venklasen et al., yet has been found to be efficient and effective in providing proximity effect correction.

In particular, the Veneklasen et al. reference discloses that for long range effects, a specific algorithm for dose modification of all pixels is applied to the modified map to calculate a correction map (Veneklasen et al., col.6, lines 23 - 26). The Veneklasen et al. reference discloses that the specific algorithm employed may vary, and may be selected as a design choice (Veneklasen et al., col.6, lines 26 - 33). An example of such a possible algorithm for a correction dose modifier is provided in equation (3) (Veneklasen et al., col.6, lines 34 - 52), which is applied to each pixel. The Veneklasen et al. reference discloses that the correction dose modifier is unique for each context, and that the data may be used as lookup address data (Veneklasen et al., col.6, lines 57 - 59).

For short range effects, the Veneklasen et al. reference discloses that a normalized point spread function $\theta(x',y')$ is employed (Veneklasen et al., col.7, lines 63 - 65) for each type of possible pattern context, such as edges occurring in a 3x3 array (Veneklasen et al., col.8, lines 1 - 3). The Veneklasen et al. reference discloses that since there is a limited number of possible edge patterns, these may be easily recognized and corrected by finding the appropriate multiplier in a lookup table (Veneklasen et al., col.8, lines 11 - 14).

For global thermal expansion, the Veneklasen et al. reference discloses that a global thermal expansion map is generated based on pattern coverage data P_{kl} as well as coverage data for proximity correction (Veneklasen et al., col.10, lines 10 - 14), and that any number of existing finite element analysis programs for calculating thermal expansion behavior can be used

(Veneklasen et al., col.10, lines 15 - 17).

The Veneklasen et al. reference, therefore, clearly discloses that the determination of the amount of correction necessary is provided by specified algorithms that are applied to the desired pattern. In contrast, in accordance with an embodiment the present invention involves determining a difference between the desired pattern and an exposed pattern for each spot (x,y), determining a nearest exposed spot (x_i,y_i), modifying the nearest exposed spot (x_i,y_i) based on the sign and magnitude of the difference at spot (x,y), and then repeating the process for each spot (x,y) until the exposed pattern sufficiently conforms to the desired pattern. This iterative process is very different than the Veneklasen et al. method of applying a generalized algorithm to the modified map to obtain a corrected map.

The Ashton et al. reference also discloses the use of a conventional correction approximation algorithm (Ashton et al., col.8, lines 41 - 50), and states that proximity correction programs incorporating such algorithms give good results and have acceptable CPU time requirements as long as the minimum feature size is not too small (Ashton et al., col.8, lines 54 - 61). The Ashton et al. reference also discloses that if the minimum feature size decreases to below for example, 0.25 μm (Ashton et al., col.8, lines 65 - 69), then the above conventional method may be applied separately to individual groups of cells with each cell receiving a uniform correction throughout the cell (Ashton et al., col.9 , line 44 - col.10, line 10). As discussed above in connection with the Veneklasen et al. reference, the process of the invention is very different than the method of applying a generalized correction algorithm.

Claim 1 is directed to a system that includes, in part, error determination means for

determining an amount of error associated with a spot at (x,y) in a binary pattern to be imaged, determination means for determining the location of a nearest exposed spot at (x_i, y_i) for each spot (x,y), and dose modification means for modifying an exposure dose at the nearest exposed spot (x_i, y_i) for each spot (x,y). The Veneklasen et al. reference includes no disclosure, teaching or suggestion of the determination of an amount of error, but rather discloses applying a generalized algorithm to a modified map to achieve a corrected map, so the amount of error is not, in fact, determined. The Veneklasen et al. reference also includes no disclosure, teaching or suggestion of the modification of a nearest exposed spot (x_i,y_i), but rather discloses that each site (x,y) is modified based on the values obtained in the corrected map for each site (x,y). The Ashton et al. reference also does not disclose error determination means for determining an amount of error associated with a spot at (x,y) in a binary pattern to be imaged, determination means for determining the location of a nearest exposed spot (x_i, y_i) for each spot (x,y), or dose modification means for modifying an exposure dose at the nearest exposed spot at (x_i, y_i) for each spot at (x,y).

Claim 1, therefore, is submitted to be in condition for allowance. Each of claims 2 - 6 depends directly from claim 1 and further limits the subject matter thereof. For example, claim 6 further requires repetition means for iteratively determining the amount of error associated with a spot (x,y). Each of claims 1 - 6, therefore, is submitted to be in condition for allowance.

Independent claim 7 is directed to a system that includes, at least, error determination means for determining an amount of error associated with a spot at (x,y) in a binary pattern to be imaged, determination means for determining the location of a nearest exposed spot (x_i, y_i) for

each spot (x,y), and dose modification means for modifying an exposure dose at the nearest exposed spot at (x_i, y_i) for each spot at (x,y).

Again, neither the Veneklasen et al. reference nor the Ashton et al. reference includes any disclosure, teaching or suggestion of the determination of an amount of error, determining a location of a nearest exposed spot (x_i,y_i), or the modification of a nearest exposed spot (x_i,y_i). Claim 7, therefore, is submitted to be in condition for allowance. Each of claims 8 - 10 depends directly from claim 7 and further limits the subject matter thereof. Each of claims 7 - 10, therefore, is submitted to be in condition for allowance.

Independent claim 11 is directed to a method of providing error correction in an imaging system, an includes, in part, the steps of determining an amount of error associated with a spot at (x,y) in a binary pattern to be imaged, determining the location of a nearest exposed spot at (x_i, y_i) for each spot at (x,y), and modifying an exposure dose at the nearest exposed spot at (x_i, y_i) for each spot at (x,y). Independent claim 17 is directed to a method that includes, in part, the steps of determining an amount of error associated with a spot at (x,y), determining the location of a nearest exposed spot at (x_i, y_i) for each spot at (x,y), and modifying an exposure dose at the nearest exposed spot at (x_i, y_i) for each spot at (x,y). For the reasons discussed above with reference to claims 1 and 7, each of method claims 11 and 17 is submitted to be in condition for allowance. Each of dependent claims 12 - 16 depends from claim 11, each of dependent claims 18 - 20 depends from claim 17. Each of claims 11 - 20 is submitted to be in condition for allowance.

Each of claims 1 - 20 is considered to be in condition for allowance. Favorable action

consistent with the above is respectfully requested.

Respectfully submitted,

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